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The use of differential reinforcement to increase participation/engagement in children with autism in an inclusion setting

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Abstract

Children with autism spectrum disorder (ASD) would gain more from instructional material if they increased their participation and engagement in general education classrooms. However, these children often grow dependent on prompts from teachers and paraprofessionals to participate. This can impede the children from participating independently in other settings and from engaging with the instructional material presented to them. The purpose of this study was to increase independent participation, while decreasing the prompt dependency of 3 children with ASD in a general education classroom. The use of differential reinforcement and prompt fading increased the hand raising behavior of all three participants in this study. Prompts were faded sequentially and all participants reached verbal prompting; they all increased independent hand-raising at the conclusion of the study.

Introduction

Autism spectrum disorder (ASD) is a pervasive developmental disorder characterized by deficits in social skills, communication, and repetitive or restricted interests, as well as many challenging behaviors (American Psychiatric Association, 2013; MacDonald, Lord, & Ulrich, 2013). It can be difficult to determine the best placement for children with ASD in public school settings due to the severity of their disability, communication delays, disruptive behaviors, and lack of resources and assistance, among many other issues. Many people are proponents of including children with autism in general education classrooms with their typically developing peers because of the potential benefits they provide to the children with ASD. These include: increased opportunities for social interactions with typically developing peers, the possibility of forming friendships, increased social and communication skills, adaptive behavior skills, learning the same material as typically developing peers, and the ability to participate in age-appropriate activities that allow the students to have social interactions that could be advantageous to life after graduation (McCurdy & Cole, 2014).

Although there are advantages to the inclusion of children with ASD, there are also some shortcomings. Children with ASD can display disruptive, off-task behaviors due to delays in communication, language, and social development (Buschbacher & Fox, 2003). These disruptive behaviors interfere with the learning of children with ASD, as well as their peers in the classroom. This behavior can often lead to the removal of students to special education classrooms (McCurdy & Cole, 2014). These off-task behaviors, along with other characteristics of ASD, can impede these children from participating in classroom activities, learning opportunities, and group instruction.

Missing group instruction can be a major detriment to children because teachers frequently present novel academic material in group instructional settings. Children may have difficulty keeping up with the academic material presented in the classroom if they are consistently removed during this time period due to off-task, disruptive behavior.

Although there are advantages for including children with autism in general education classrooms, there needs to be a formal method to allow teachers and parents alike to determine the best environment for each child. Children with autism, and those with developmental disabilities in general, have the same rights and requirements to attend public schools as typically developing children. The inclusion of these students in general education classrooms has greatly increased since the implementation of the Individuals with Disabilities Education Act (IDEA) of 1997 (Sonnenmeier, McSheehan, & Jorgensen, 2005). The introduction of IDEA provided teachers, parents, and legislatures with a starting point for determining the percentage of time children with disabilities should be included in classrooms with their typically developing peers. The newest revision to the IDEA of 2004 states that children with disabilities must be taught in general education classrooms with their typically developing peers to the maximum extent possible. Children with disabilities can only be removed from general education settings when they cannot receive satisfactory education due to the severity or nature of their disabilities. They may then be placed in special education classrooms where they can be provided with the appropriate services and teacher supports (McCurdy & Cole, 2014).

There are other barriers for children with ASD who are taught in group instructional settings. They may have difficulty attending to verbal material presented

during the instruction, and they may have difficulty comprehending different stimuli presented during the lesson (Hume, Plavnick, & Odom, 2012). Children with ASD are either removed from the classroom during this time due to their behavior, or they gain little from the instructional setting because of their lack of engagement (McCurdy & Cole, 2014). These students often need frequent prompting to pay attention and to engage with the materials or to be redirected back to the work that is being presented. This may result in children becoming increasingly dependent on prompts from the teacher or the paraprofessional to engage in the instruction and to remain on-task. These prompts can prevent the students from responding independently and decrease their participation in group settings. This can cause the students to become reliant on others, such as paraprofessionals, to respond and/or participate in the classroom (Crowley, McLaughlin, & Kahn, 2013). This dependency may continue throughout children's educational careers if they are not taught to how respond independently in the classroom.

Collins (2012) outlined a hierarchy of prompts that can be used to decrease prompt dependency and increase independent responding. He used a graduated-guidance procedure called most-to-least prompting. Most-to-least prompting is an appropriate procedure to use when teaching a new behavior, working with young children, and/or teaching children with intellectual disabilities. Researchers/teachers began with the most intrusive prompt and systematically fades their prompting until independent responding is accomplished. The most intrusive prompt is generally a full physical prompt, and the level of prompting is moved successively through a predetermined sequence in order for the child to perform the correct response. A minimum of three prompt levels is required, and children should only be moved through the prompts as they are ready and have

established the ability to perform the more intrusive prompt level. Researcher can move through the prompts in a couple of ways, or they can combine both methods. They may rely on personal judgment to move the learner through the sequence or they may have a predetermined number of sessions before they move on to the next stage in the sequence. With either of these options the teachers can move the child back in the sequence if they feel that the child is not being successful at the next level.

Along with a prompting procedure, the use of differential reinforcement of incompatible behavior (DRI) can be used to increase an appropriate behavior that cannot occur simultaneously with the problem behavior. Teachers, for example, can easily use a DRI procedure in the classroom to reinforce desired behaviors, such as students remaining in their seats during instruction (Cooper, Herward, & Heron, 2007). Karsten and Carr (2009) used differential reinforcement to teach skill acquisitions to children with autism. They compared differential reinforcement of unprompted responses to nondifferential reinforcement of both prompted and unprompted responses on the skill acquisition of two children with autism. Each of the children were a part of a general education classroom and had a paraprofessional who provided them with support throughout their entire school day. An alternating-treatments design was used to assess the effectiveness of differential reinforcement of unprompted behavior versus nondifferential reinforcement of prompted and unprompted behavior. One participant had to arrange a set of three pictures in chronological sequence and the other participant had to tact an assortment of emotions or actions of pictures. Praise from the researcher accompanied with a highly preferred item as determined by a preference assessment was provided throughout the experiment. The researchers found that differential

reinforcement of unprompted responding was the most suitable method for teaching children with autism novel skills.

Although decreasing prompt dependency using differential reinforcement is a well-understood concept, very little research has been gathered on decreasing prompt dependency while increasing independent responding during group instruction. Research in this area could enable students to learn how to actively participate in their classroom, while providing them with the ability to generalize that skill to other educational settings. Decreasing prompt dependency could also allow them to become independent in the classroom while becoming less reliant on paraprofessionals and teachers to respond to a variety of instructions. For these reasons, it is extremely beneficial to have research-based, individualized instruction that can be easily adapted for a variety of children to teach them how to participate in group instructional settings to increase their engagement with the material (Crowley, McLaughlin, & Kahn, 2013). Participation in group settings is especially important in elementary school where the majority of educational material is presented in the form of group instruction (Dawson & Faja, 2008).

Engagement in-group instructional settings has different dimensions than engagement in independent classroom activities and materials. Children must attend to the teacher presenting the lesson, sit in their seats without disruptive behaviors, and attend to the board and the academic materials that accompany the lecture. Attending to the teacher in a classroom can be difficult for children with autism. They often display disruptive behaviors that are incompatible with learning and engaging in classroom activities. Active participation in academics is important, and children are expected to engage in and practice these fundamental skills both within and outside of the classroom

(Koegel, Singh, & Koegel, 2010). In order for children to be successful in school, attention to the teacher has obvious benefits: increased attention, increased participation, and deceased incompatible behavior. For example, Charania et al. (2010) tried to increase the participation of three children with ASD and decrease their incompatible behaviors through discrimination training in which they taught the children when it was appropriate to raise their hands and when it was appropriate to keep their hands down.

Charania et al. (2010) wanted children to learn to discriminate effectively between raising their hands when they had an answer to a question and keeping their hands on their desk for questions for which they did not have answers. During baseline all three children initially failed to raise their hands in small-group instruction to questions they had previously answered correctly. The experiment began with three different group instructional tasks containing three participants; the training was completed in a room that included three participants and two experimenters. The first task required each participant to look inside a bag that was given to him or her; they were instructed to raise their hands if the item in the bag was requested. In the second task, the teacher whispered a "secret word" to one of the participants and a greeting to the other two children; the teacher then instructed the students raise their hands if they heard her say the "secret word." The third task was the most difficult of the three: The experimenter asked the children to raise their hands if they knew the answer to the presented question. Prompting was used to help the children raise their hands at the correct time and reinforcement was provided when they raised their hands correctly, either with a prompt or independently. The initial rule was given before each task and after an incorrect response, ""If you know it or have it, raise your hand; otherwise wait for another

question." The researchers were able to increase the frequency and accuracy of hand raising and hand-down behavior in all three children.

Kern, Delaney, Clarke, Dunlap, and Childs (2011) also tried to decrease disruptive behavior to increase task engagement. Instead of teaching hand raising skills they found a preferred medium for the children to complete their work tasks. A functional assessment found that both participants displayed their problem behavior to escape writing assignments. The researchers hypothesized that the frequency of the disruptive behavior would decrease if the students were given preferred activities to complete their assigned work. This intervention was effective in increasing the words written per minute and decreasing the disruptive behavior for both of the participants.

Kern et al.'s (2011) findings suggest that students who have effective behavior management strategies in place may be able to increase their engagement with academic material. However, these children may still need to be taught how to participate in a group instructional setting. For example, McCurdy and Cole (2014) used peer supports to promote academic engagement of students with autism in a general education setting. They paired each participant child with ASD with a typically developing peer to encourage social interactions as well as to require less direction from the paraprofessional. McCurdy and Cole proposed that if students with ASD could be redirected to their work with the aid of a peer support, then they might be included more frequently in their classroom when the paraprofessional was not available. Each participant in the experiment displayed a form of disruptive behavior, such as crawling on the floor, talking to peers during quiet time, or laying their heads down on the desk during instruction. These behaviors were disruptive to their work as well as to their peers.

The results showed that all three participants displayed decreased levels of off-task behavior, and this decrease maintained throughout the intervention. One participant needed to use the additional support of a MotivAider timer due to an increase in off-task behavior after the intervention. This intervention enabled the students to have decreased interactions with the paraprofessionals, increased engagement in their academic material and increased social interactions with their peers.

The previous experiments were successful in decreasing disruptive, off-task behavior while increasing the desired behavior; however, general education teachers would have difficulty conducting many of those interventions in the classroom. Many of the interventions used in general education settings also aim to reduce disruptive, off-task behavior, while increasing desired behaviors so that children can better attend (Harrower & Dunlap, 2001). Many of the interventions have included: using peer supports, visual schedules, antecedent procedures, and self-monitoring. If children with ASD display disruptive behaviors, then they may be removed from the classroom to receive training to increase participation. This can be a burden to general education teachers who may not have the time or resources to work with children in small, individualized groups. These teachers need an intervention that can be applied directly in classroom settings with other typically developing children present. The intervention needs to be simple, applied in a short amount of time, effective in-group settings, and applicable to other children in the classroom so that there are not specific students who are singled out (Lindsay, Proloux, Thomson, & Scott, 2013).

Limited research exists on how to teach children with autism to participate in group instruction facilitated by a general education teacher within classroom settings.

Research in this area research could decrease the disruptive behavior of children with ASD, while providing general education teachers with an effective way to encourage hand-raising, offering answers, and participating in classroom activities. Hand-raising is an important precursor skill to classroom participation and it would enable teachers to see the current skill level of students and provide the teacher with an instance to reinforce the child for participating. This would allow the teacher to provide an easy intervention in the classroom that does not require extra training or make the child stand out from their peers; the teacher could also apply differential reinforcement of incompatible behavior to all the children in the classroom to increase the overall participation during group instruction.

Method

Participants

Three elementary school participants (ages 8-10) attending a public school participated. The students were diagnosed with ASD. They spent the majority of their school day in an inclusive setting with typically developing peers. Participants were chosen for this research from an autism classroom based on the amount of time they spent in the inclusive setting. The participants were required to spend the majority of their academic day in a general education classroom with the help of a paraprofessional. Participants had demonstrated the ability to raise their hands in class, prior to the beginning of the study. Informed consent forms were provided and were filled out by parents or legal guardians, which is consistent with the research protocol approved by the JMU Institutional Review Board on the Use of Human Subjects in Research.

Two graduate students trained in applied behavior analysis and two paraprofessionals with Registered Behavior Technician training participated in the research. The graduate students were females who had previous clinical research through their graduate program or public school setting. One was assigned to each of the three children randomly each day. One paraprofessional provided reinforcement to the children based on their participation, while the two graduate students collected data based on the participants' performance.

Setting

All research took place in each participant's homeroom which is an inclusive classroom within a public elementary school. Two of the participants were in the third grade, with the same homeroom teacher, and one participant was in fourth grade with a

different homeroom teacher. The participant's classrooms contained three computers, a Smartboard, student's individual desks, two bulletin boards, one window, and a tiled floor. Each classroom was about 6 meters long by 8 meters wide.

Materials

The paraprofessional who worked with each participant was seated in a chair in close proximity, approximately 1 meter away from the participant. The two other therapists had a data sheet, a pen, and a stopwatch to collect data on the participants in partial interval recording of 15-seconds for ten-minute sessions. The data sheet can be seen in Appendix A.

Dependent Variables

The goal of this study was to increase the participation of children with autism in an inclusive setting. The paraprofessional provided positive praise, positive touch, or both to the students when they participated in the classroom. Examples of positive praise were "good job raising your hand" or "I like how you raised your hand to answer that question." Examples of positive touch were high fives or gently patting the child on the shoulder. Participation was counted when the child raised his or her hand above shoulder level, with all five fingertips above the uppermost tip of their ear to comply with a question given by the teacher to either the individual student or the class as a whole. A question was counted when the teacher used a verbal inquiry by having a rising inflection at the end of the sentence; it requested specific information from the child (Eyberg, Nelson, Duke, & Boggs, 2009).

Data Collection

The child and the teacher behavior were observed, and data were collected in live coding sessions. Data were collected for a ten-minute partial-interval schedule for both the student and the teacher three days a week. The teacher behavior was recorded by marking when the teacher asked questions within each interval. The percentage of questions asked was converted to a percentage to allow the researcher to determine when there was an opportunity for the participant to raise their hand. A teacher questions was only recorded if the question required the individual or the class as a whole to raise their hand. If the teacher asked a question and the participant did not raise their hand, then it was counted as missed opportunity for the child to be prompted or independently raise their hand. Child hand-raising was recorded on a fifteen-second partial-interval schedule to allow for a more accurate reflection of response per opportunity. The consequence that the child received from the paraprofessional was also noted to ensure that the child was receiving reinforcement for the desired behavior. Verbal and modeled responses were recorded on the data sheet under the area designated for partial prompts: A capital V was marked in the box if a verbal prompt was used, and a capital M was marked in the box if a model prompt was used. Definitions for these behaviors can be found in Appendix B.

Experimental Design

This experiment was conducted using a multiple-baseline-across-participants design. In this design, experimental control was demonstrated by the sequential introduction of reinforcement strategies and the effects that are observed on the participant's behavior at the point of the intervention (Kazdin, 2011). Six data points

were gathered on each participant in baseline; the participant with the most stable baseline received treatment first while the other participants remained in baseline. Stability was determined by referring to the trend, level and variability of data paths; the participant with the most balanced trend and level and least variability in the data was placed in intervention first. Intervention with the second participant occurred after the first participant showed stable data in the intervention condition. The third participant remained in the baseline condition until the second participant showed stable data in the intervention condition and a stable trend was observed from the last participant.

Data Analysis

The collected data for a multiple-baseline design is visually displayed on line graphs. The consumer of the graphs analyzes them and determines if there is a noticeable, visual change in the data between baseline and treatment conditions (Kazdin, 2011; Parsonson, 2003). Changes can be determined by assessing the changes in slope or level, which allows the consumer to see whether the behavior was occurring at a high or low rate; and the variability of the data points. Data was analyzed by a supervisor and the two graduate students during baseline and in each leg of the design. All decisions regarding participant's intervention as well as remaining in baseline were discussed and agreed upon as a group before any changes were made. All data analysis and intervention decisions were directed by the guidelines set forth in Parsonson, 2003.

Interobserver Agreement

Interobserver agreement (IOA) was calculated on 30% of observations between the graduate student observers. The IOA was conducted both on the teachers behavior, frequency of questions, and on the students' behavior, frequency of hand-raising, and

type of consequence. The overall occurrences of each behavior were totaled and compared between each observer to determine the percent of IOA between them. In a ten-minute partial interval observation period, the observers must agree on 85 percent of their behaviors in order for the session to be reliable (Cooper et al., 2007). IOA was calculated as the number of agreements divided by the total number of agreements plus disagreements, multiplied by 100 to give a percentage agreement (Cooper et al., 2007). IOA ranged between 97-100% throughout the study with an overall average of 99.7% which is acceptable according to usual practice.

Procedures

Researchers observed the participants and their participation based on the requirements set forth by the teachers in each of their respective classrooms. The students and paraprofessional responsible for observation, data collection, working with the participants, and other aspects of the research were supervised by licensed behavior analysts. Both supervisors were board certified behavior analysts who had previous supervision experience.

Each paraprofessional was trained on how to prompt and reinforce hand raising behavior. The behavior definitions were discussed with both paraprofessionals and the researcher explained the process of most-to-least prompting. The paraprofessionals were told to provide prompting in sequential fashion starting with a full physical prompt, partial physical prompt, model, verbal, and then independent hand-raising. Praise was to be provided after every instance of a hand raise. The paraprofessionals first did three trials of full physical prompting. If the child was successful in this step, they would move to partial physical prompting. If the child was successful with the next step then

the paraprofessional would complete three more trials before they moved on in the sequence; if the child was unsuccessful, then they would return to the previous chain in the sequence and do this step again for three more times. Both paraprofessionals worked with the students on a regular basis and were told that if they felt the child could move on before three trials, then it was at their discretion to do so. Some of the children were able to move through steps more quickly than others and it would have led to disruptive behavior if they continued to receive a full physical prompt when they only needed a verbal prompt. Once the sequencing was explained and all questions were answered, practice trials were conducted. The researcher asked questions and both paraprofessionals had to practice the prompting procedures on each other until they completed the sequencing and reinforcement with 100% accuracy (Collins, B., 2012).

At the beginning of each session, the paraprofessional providing reinforcement to the child sat in close proximity to the child so that they could hear the teacher speaking and see and reinforce hand-raising behavior. The two therapists who collected data gathered their data sheets, pen, and stopwatch to prepare for the data collection sessions.

Initial baseline data were gathered three times per week by the graduate students during the teaching of mathematics and science. Each session occurred during the same class period from 10:10-11:30 AM and from 1:00-1:40 PM in the participant's general education classrooms. Both of the general education teachers noted that mathematics and science would be the most appropriate times to observe the students and collect data due to the length of the lecture and the opportunities for participation. During the intervention condition the paraprofessional sat approximately one meter away from the

participant and provided positive praise and/or positive touch to the participant when they raised their hand in compliance to a teachers' question.

The two observers simultaneously and independently collected data, in a ten-minute partial-interval schedule on the participants and teacher's behavior. They scored questions asked by teachers in a group instructional setting, the prompt level of participants hand-raising behavior, and if reinforcement was provided following a participants correctly raised hand. The observers sat at least one-meter apart so that they did not observe each other's records. Once all the data had been collected for the day, IOA was calculated for each participant.

Data were gathered first to determine each participant's initial frequency of responding, as well as the frequency of questions provided by the teacher. Baseline data were also collected on the initial reinforcement provided to the student from the paraprofessional who works with them everyday. This allowed the graduate student to see if reinforcement was being provided to the participants dependent upon their hand raising behavior.

Once a stable baseline was established for a participant's hand-raising, the paraprofessional sat next to the first student and provided positive consequences per occurrence for hand-raising behavior. Stability was determined when the participants' graphs did not display an upward or downward trend and when the data points were level (Cooper et al., 2007). Two observers collected participant and teacher data; the observers could refer back to the behavior definition sheet at all to times to help reduce observer drift and maintain fidelity. The intervention was implemented with the second participant once stable responding had been established in the treatment phase of the first

participant. This continued sequentially until all three of the participants received treatment.

Social Validity

Upon completion of the study, each teacher completed a social validity questionnaire to rate the appropriateness of the procedures, social significance of the goals, and social importance of the effects. The teachers were also encouraged to make any additional comments that they feel would improve the study if it were to be replicated in the future (Wolf, 1978). This form can be found in Appendix C.

If the paraprofessionals provided less than 80% reinforcement for hand raising for the session they were reminded before the next session that they should reinforce hand raising in every instance. They were also shown their graphs to provide them with a visual as to how frequently hand raising behavior happened and how frequently it was reinforced.

Results

The results of all three participants are represented in Figures 1 and 2. Figure 1 shows the percentage per occurrence of overall hand-raising and reinforcement provided for hand raising. Blake increased his average overall hand-raising from 4% during baseline to an average of 85% after intervention; the reinforcement provided increased from an average of 17% during baseline to an average of 73% after intervention. Anders increased his average overall hand-raising from 24% during baseline to 95% percent after intervention; the reinforcement provided increased from an average of 20% during baseline to 95% after intervention. Adam increased his average overall hand-raising

from 4% during baseline to 87% after intervention; the reinforcement provided increased from and average of 21% during baseline to 94% after intervention.

Figure 2 shows the percentage per occurrences of independent hand-raising, full physical prompting, partial prompting (which includes partial physical, verbal, and model), and reinforcement provided for had raising. During baseline Blake raised his hand independently 4% per opportunity, he was full-physical prompted 0%, partial-physical prompted 0%, and reinforcement was provided 17% per occurrence of hand-raising. After intervention he raised his hand independently 2% per opportunity, he was full-physical prompted 2.5%, partial-physical prompted 79%, and reinforcement was provided 75% per occurrence of hand raising. Independent hand raising increased an average of 2%, full physical prompting increased an average of 2.5%, partial-physical prompting increased an average of 79%, and reinforcement provided increased an average of 58%.

During baseline, Anders raised his hand independently 24% per opportunity, he was full-physical prompted 0%, partial-physical prompted 0%, and reinforcement was provided 20% per occurrence of hand raising. After intervention he raised his hand independently 41% per opportunity, he was full-physical prompted 0%, partial-physical prompted 54%, and reinforcement was provided 95% per occurrence of hand raising. Independent hand-raising increased an average of 18%, full-physical prompting remained the same, 0%, partial-physical prompting increased an average of 54%, and reinforcement provided increased an average of 75%.

During baseline, Adam raised his hand independently 4% per opportunity; he was full-physical prompted 0%, partial-physical prompted 0.80%, and reinforcement was

provided 21% per occurrence of hand-raising. After intervention, he raised his hand independently 38% per opportunity; he was full-physical prompted 0%, partial-physical prompted 48%, and reinforcement was provided 94% per occurrence of hand-raising. Independent hand-raising increased an average of 34%, full-physical prompting remained the same, 0%, partial-physical prompting increased an average of 47%, and reinforcement provided increased an average of 73%.

Social validity questionnaires were filled out by the teachers at the conclusion of the research. The teachers rated the social validity of the research on a likert scale of 5-1, where 5 represented agree, 4 represented somewhat agree, 3 was neutral, 2 represented somewhat disagree, and 1 represented disagree. The teachers rated the appropriateness of procedures, the social significance of goals, and the social importance of the effects. The teachers rated the appropriateness of the procedures as follows: “The training procedure was unobtrusive and did not affect the teaching of the class.” was rated as a 5 by both teachers; “The researcher understood and communicated effectively with me throughout the research process.” was rated on a range of 5-2 with and average of 3.5; “I would recommend a similar procedure for other children in an inclusive setting.” was on a range of 5-4 with and average of 4.5; “It is important to teach this skill to help the child participate in the general education classroom.” was rated on a range of 5-4 with and average of 4.5; “The child learned beneficial skills during this procedure.” was rated on a range of 5-3 with an average of 4; and “I will likely use this procedure to encourage hand raising with other children in the future.” was rated on a range of 5-2 with and average of 3.5. The results from the social validity questionnaire can be seen in Figure 1.

Discussion

Within a multiple-baseline design, this study demonstrated a procedure to fade prompts provided to children with autism in a general education setting. The research showed the importance of a systematic approach in fading prompting procedures to allow children to respond independently in the classroom. Some of the participants displayed more independent responding in baseline than others; this skill was learned more quickly in the children who displayed this behavior more frequently in baseline.

Figure 1 is representative of the correct sequencing by the paraprofessional providing prompting and reinforcement to the participants. The children should have been given three prompts and then moved on to the next prompt level in the sequence; if the children were unsuccessful with the less intrusive prompt, then they should have been moved back one step in the sequence. Figure 1 displays the sequencing by the paraprofessionals; Anders and Adam were prompted and correctly sequenced the majority of the time; however, the paraprofessional that worked with Blake had more difficulty following the correct sequencing every session. Sometimes she moved the child through the sequence correctly; however, there were also times that she did not move Blake quickly enough through the prompting procedure. This may have contributed to his dependence on verbal prompts as well as the difficult transition from verbal prompt to independent hand-raising.

Figure 2 represents child behavior as well as paraprofessional behavior. As the more intrusive prompt decreased, the less intrusive prompt should have increased. This should have happened until partial prompting decreased while independent hand-raising increased. These results can be seen with Anders and Adam, as their independent

responding increased the partial prompting decreased. Blake's results were more variable and the more intrusive prompts were not always faded when the less intrusive prompt was needed. This may explain why Blake received a high level of partial prompting at the conclusion of the research.

The children generally moved though the sequential processes quickly. They began with full physical prompting, but that quickly transferred to partial prompting and modeled hand-raising; however, it was more difficult and time-consuming for the children to move from verbal prompting to independent hand raising. If the study had been conducted for a longer period of time, the children may have been able to further fade the prompts during hand-raising.

The data was collected as percentage per occurrence of hand raising-behavior. If a teacher did not ask a question it was not counted as a zero, it was left as an unscored interval and was not include in the percentage per opportunity data. An interval was scored if a teacher asked a question in that interval; the prompt level, independent hand-raising, and consequence were then scored and compared according to the opportunity for these behaviors to occur. For example, if a teacher asked twenty questions in a ten-minute observation period and the participant raised their hand eighteen times within that session, then hand -aising was scored as 18 out of 20 opportunities or 90%. The partial-interval method for collecting data underestimated the number of questions and responses that were given in the ten-minute observation periods; only one question was counted if two questions were asked in the same interval.

Both general education teachers were interviewed prior to data collection to determine the average percentage of time that they felt the typically developing peers

raised their hands to answer questions during group instruction. One teacher said that the majority of her class raised their hands about 70-75% of the time to answer questions, with the exception of two to three children on the higher or lower end. The other teacher said that the majority of her class raised their hands about 80% of the time to answer questions, again with the exception of two to three children on the higher or lower end. While some of the children in this study raised their 100% of the time during intervention, they should not be held above the standards of their peers. Increased hand raising behavior for these children to 80% of the intervals was considered on par with their peers and successful for this study.

This research supported Collins (2012) model of most-to-least prompting; prompts can be faded in a systematic way that allows an individual to be more independent in their responding. This was an appropriate procedure to use when the sequencing was followed correctly and faded quickly enough. It may be beneficial to have the participants follow a more rigorous sequencing style and not allow them to rely on their personal judgment to fade the prompting.

This research also supported the idea that a DRI can be used effectively in the classroom (Copper et. al., 2007). The paraprofessionals were able to reinforce the participants throughout the research for their hand-raising behavior. This is reflected in Figure 1, there was an increase in reinforcement between baseline and intervention across all three participants. While no direct data was collected on the general education teachers, it should be noted that they increased their positive reinforcement to the participants as well as the other children in the classroom. They began using statements such as, “I like how you raised your hand,” or “Nice raising your hands.” This supports

the idea that the intervention needs to be simple, applied in a short amount of time, and applicable to other children in the classroom (Lindsay et al., 2013).

Both teachers completed a social validity questionnaire at the conclusion of the research. They rated the appropriateness of the procedures, the social significance of the goals, as well as the social importance of the effect. The third grade general education teacher, whose classroom contained two participants, felt that the procedures were effective, that the children learned beneficial skills, and that she would recommend a similar procedure for other children in an inclusive setting. The fourth grade general education teacher, whose classroom contained one participant, somewhat agreed that the procedures were effective, was neutral as to if the participant learned beneficial skills, and somewhat agreed that she would use a similar procedure for other children in the inclusive setting.

There were a few limitations that should be noted and taken into consideration. One of the paraprofessionals worked with two of the participants in the study. The reinforcement that she provided during intervention one to the first participant may have affected the amount of reinforcement she provided to the other participant who remained in baseline. It may have been beneficial to have one paraprofessional per participant. A second limitation was that two of the participants were in the same classroom while one participant was in a different classroom. All data collection was collected during the same period; however, one participant was learning in a different classroom within the school. It would be advantageous for the research if all participants were in the exact same setting together or if they were all in different settings. Lastly, one of the children began to draw inferences on what he thought the experiment entailed. Although he filled

out the child assent form, he believed that he had to raise his hand and get called on by the teacher in order to help the researcher. This caused him to have two tantrums on the first two data collection days and decreased his independent responding from baseline. The paraprofessional had to explain to him that the researcher was observing him and did not have any requirements for him. She had to explain that she was helping him to answer questions and raise his hand more in the classroom. It may be beneficial in the future to provide more explanation of the experiment to the children who are able to understand more about the different conditions.

The effectiveness of the fading of prompting procedures was measured in a short amount of time, it would be interesting to see how fading procedures would look over an extended period of time with follow-up and different environment data points to determine generalization (Stokes & Baer, 1977). Future research could expand on this and see how frequently a child raises their hand and correctly answers the delivered question.

The current research adds to the limited but developing literature on increasing participation in the general education class for children with autism while decreasing dependency on paraprofessionals and teachers. This research shows that prompting can be faded in a systematic way by using differential reinforcement and enable children to be more successful in independent hand raising during group instruction.

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Table 1

Social Validity questionnaire Results from the General Education Teachers

Social Validity Results		
Questions	**Range**	**Average**
The training procedure was unobtrusive and did not affect the teaching of the class.	5	5
The researcher understood and communicated effectively with me throughout the research process.	5-2	3.5
I would recommend a similar procedure for another student in the inclusive setting.	5-4	4.5
It is important to teach this skill to help the child participate in the general education classroom.	5-4	4.5
The child learned beneficial skills during this procedure.	5-3	4
I will likely use this procedure to encourage hand-raising with other children in the future.	5-2	3.5

Figure 1

Percentage per Opportunity of Overall Hand Raising Behavior and Reinforcement

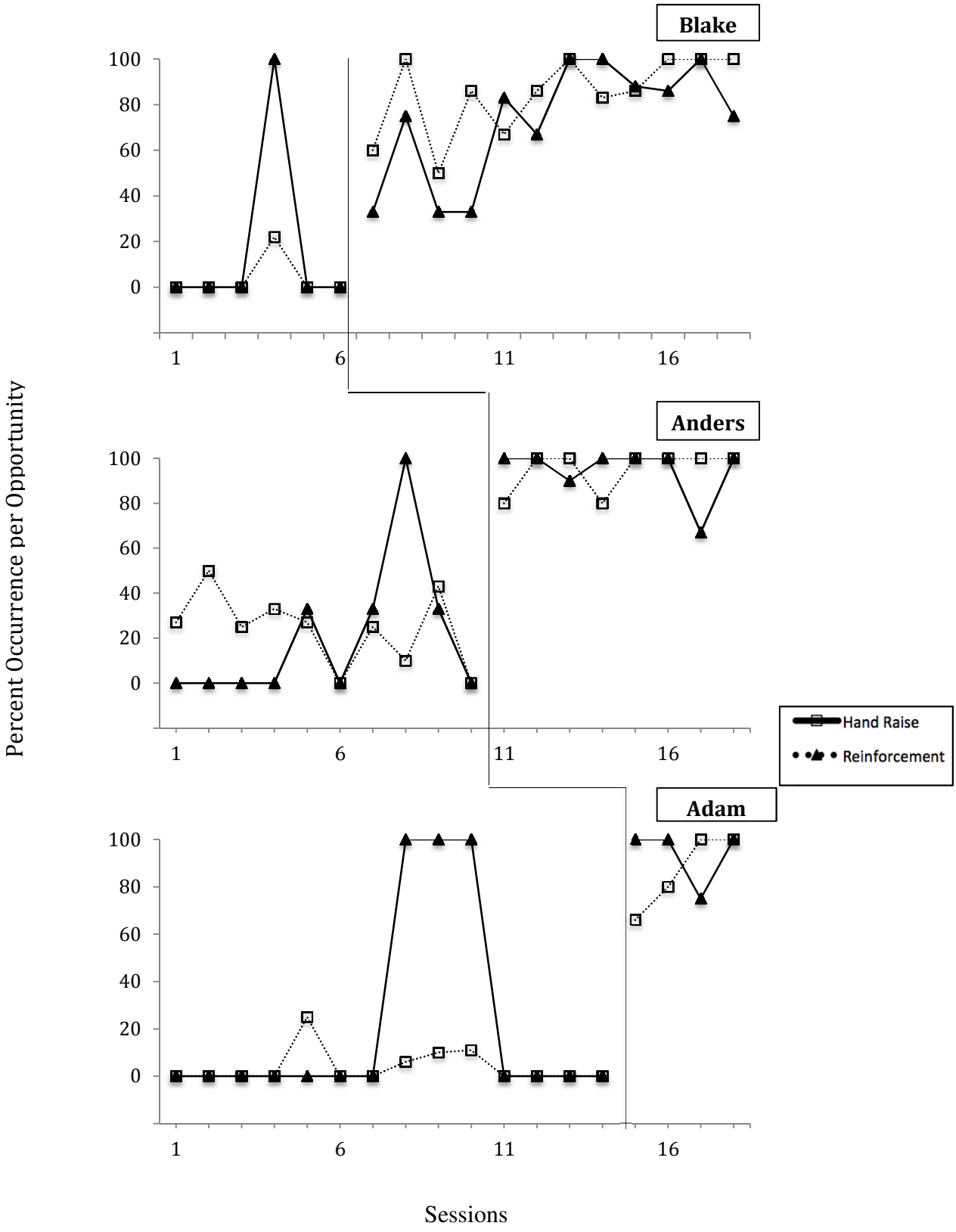
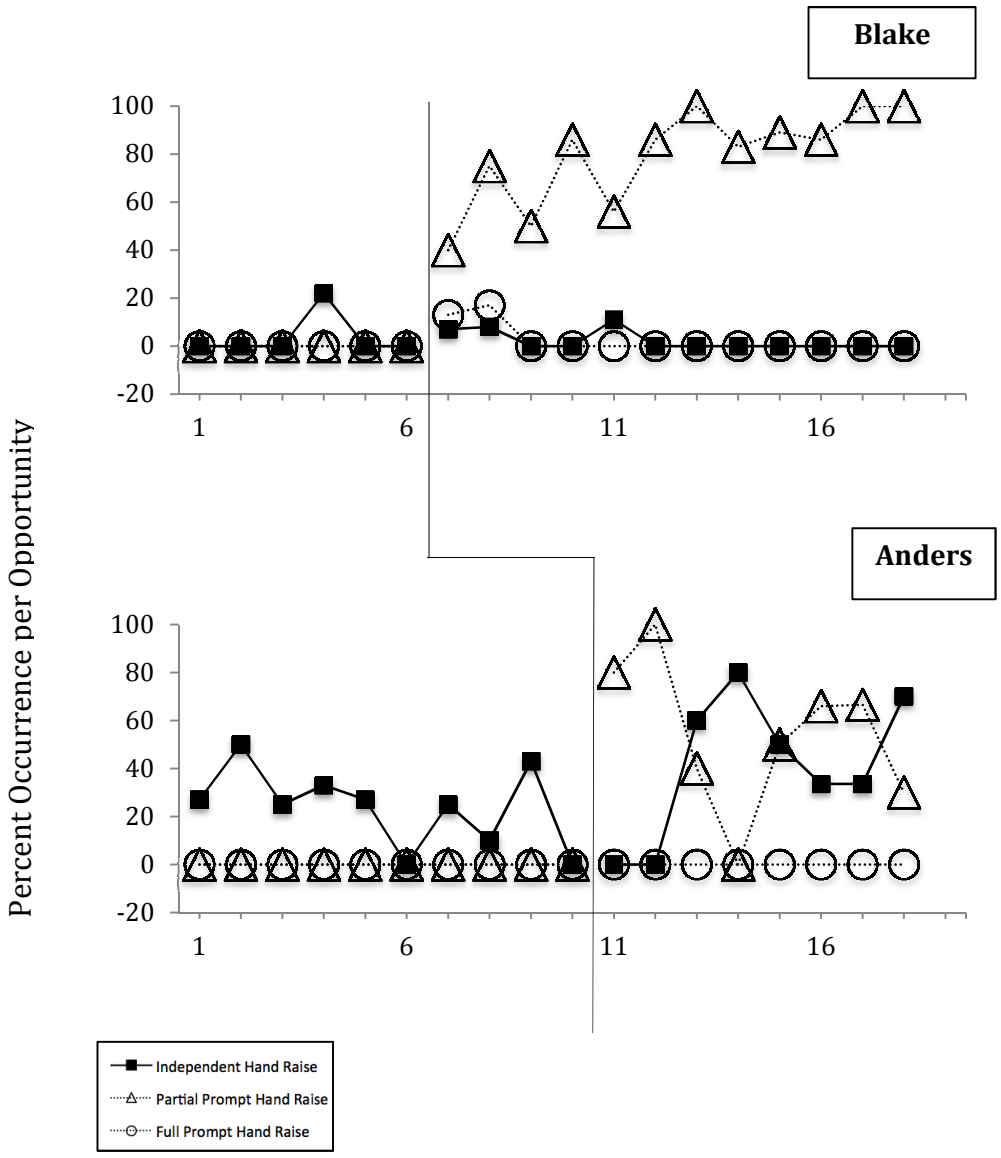
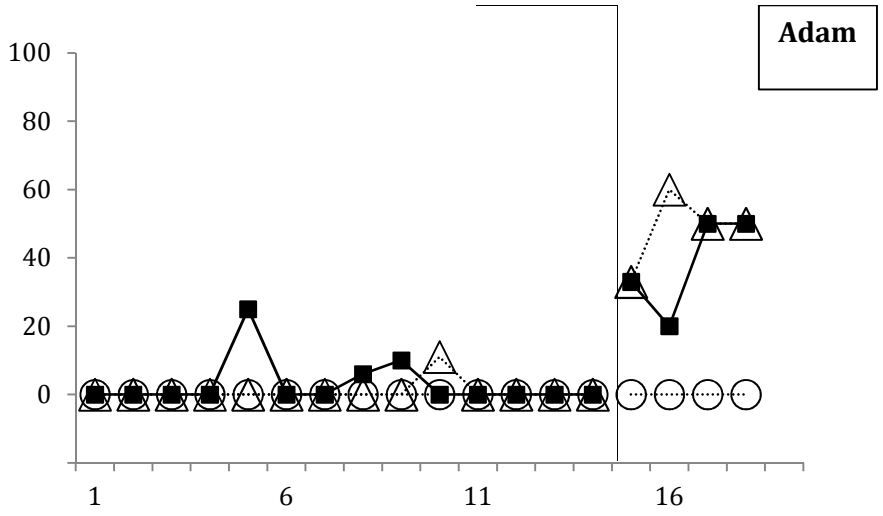


Figure 2

Percentage per Opportunity of Prompting and Reinforcement





Sessions

Data Sheet

Appendix A

Date: Observer #: Participant #: Condition: Baseline Treatment IOA: Yes No

Minute	**1**				**2**				**3**				**4**				**5**				**6**				**7**				**8**				**9**				**10**			
Interval	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Teacher Question																																								
Independent Hand Raise																																								
Partial Prompt																																								
Full Physical Prompt																																								
Reinforcement Provided																																								

Date: Observer #: Participant #: Condition: Baseline Treatment IOA: Yes No

Minute	**1**				**2**				**3**				**4**				**5**				**6**				**7**				**8**				**9**				**10**			
Interval	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Teacher Question																																								
Independent Hand Raise																																								
Partial Prompt																																								
Full Physical Prompt																																								
Reinforcement Provided																																								

Behavioral Definitions

Appendix B

Student Behavior

Hand Raising: will be counted each time the student raises their hand above shoulder level, with all five fingertips above the uppermost tip of their ear, in compliance to a question or demand provided by the teacher to the class as a whole or to the individual student.

Reinforcement Provided: any intentional positive physical contact between the therapist and the child (Eyberg et al., 2009). Providing positive evaluation of the child, an attribute of the child, or a specific or nonspecific activity, behavior, or product of the child (Eyberg et al., 2009).

Partial Prompts:

Partial Physical: a gentle touch to the elbow or wrist to serve as a reminder to the student to raise their hand.

Model: any time the therapist shows the child how to raise their hand by raising their hand themselves without using any verbal prompts.

Verbal: when the therapist verbally tells says to the child, "Raise your hand to answer the question."

Full Physical Prompt: a light grasp around the students wrist or elbow in which the therapist gently raises the students hand to above their shoulder level, with all five fingertips above the upmost tip of the ear, in compliance to a question provided by the teacher to the class as a whole or to the individual student.

Teacher Behavior

Question: A question will be counted when the teacher uses a verbal inquiry by having a rising inflection at the end of the sentence; it must request specific information from the child/children.

Social Validity Questionnaire

Appendix C

Appropriateness of Procedures

Name_____ Date: _____

Questions for Participants to Answer	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree
Appropriateness of Procedures	5	4	3	2	1
1. The training procedure was unobtrusive and did not affect the teaching of the class.					
2. The researcher understood and communicated effectively with me throughout the research process.					
Social Significance of Goals	5	4	3	2	1
3. I would recommend a similar procedure for other children in the inclusive setting.					
4. It is important to teach this skill to help the child participate in the general education classroom.					
Social Importance of the Effects	5	4	3	2	1
5. The child learned beneficial skills during this procedure.					
6. I will likely use this procedure to encourage hand raising with other children in the future.					